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San Francisco, California

1944

THE PAN-PACIFIC ENTOMOLOGIST

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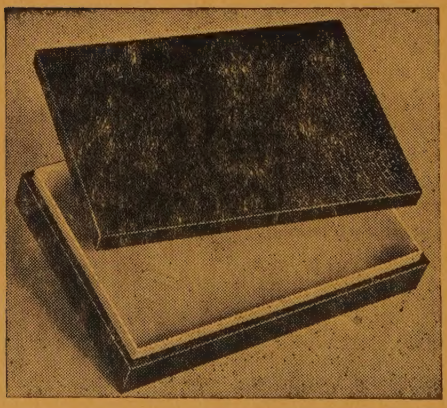

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APPLIED ENTOMOLOGICAL TAXONOMY*

BY H. H. KEIFER

Bureau of Entomology and Plant Quarantine
State Department of Agriculture, Sacramento, California

Governmental, that is tax-supported, institutions are assuming increasing responsibilities for the welfare of the general public. Tax-supported economic entomology is no exception to this, and governmental organizations are the principal places where economic entomologists find employment. When tax money is spent for arthropod taxonomy in connection with economic organizations, that taxonomy must be the kind that can be directly applied to pest control, because pest control is the chief entomological interest of the tax payer. Thus, most tax-supported taxonomists work with arthropods as they relate to legislative pest control, surveys, insect eradication, chemical control, and biological control. He must furnish identifications of species, and bionomical and distributional data. I have been engaged in this type of work for the past fifteen years, and this has given me a considerable opportunity to gain experience with, and to observe, what sort of taxonomic work is required, how adequate the existing taxonomic literature is, how specialists in this subject meet their problems, what attitude these taxonomists take toward their work, and how the institutions that need this work support their taxonomists.

From this experience I have developed the conviction that applied taxonomy can have more definite objectives than it now seems to show, with resulting benefits to economic entomology. But the responsibility and vision for maintaining such objectives must rest largely in the organizations hiring taxonomists.

We may define applied taxonomy as that portion of arthropod classification dealing with the specific identification in and the bionomical coordination of, anthropod groups containing species in competition with or dangerous to the human animal; or in groups which contain species that help control effectively the

* Presidential address read before the Pacific Coast Entomological Society on December 18, 1943.

harmful kinds. In other words, this form of taxonomy is a restricted activity. Arthropod groups having the greatest number of important species receive the most attention, with those having fewer important species receiving proportionately less.

Taxonomy in its broadest and most fundamental aspect is principally the search for facts bearing on the origin of, and interrelationships and differences between, organisms and groups of organisms. Any restriction of taxonomy such as that here treated, must rest on the fundamentals.

Our gauge, as to the direction in which the energies of applied taxonomy are expended, rests on evaluating each group of arthropods according to the number of economic species it contains. I use the word *group* because taxonomy is a science of comparison, and the taxonomist knows important species thoroughly only after he has carefully compared them with all similar species. Thus, a group may be anything from a portion of an order to part of a family. For example, a worker who compares and describes species in the scale insect group, continually sharpens his wits on identifying a considerable number of economic species. Opposed to this, a person studying dragonflies could not, by that activity, identify any economic species. This does not mean that the taxonomy of dragonflies, mayflies, and other groups we might mention, is worthless. Such studies obviously have a definite place in entomology, but are inappropriate when supported by economic organizations.

The most important activity of the applied taxonomist is the identification of species. In taxonomy which seeks the fundamentals of arthropod correlation, the identification of species may well be of secondary significance. But in economic entomology the identification of an important species is the key to the situation. It is the first step of an economic operation. It gives the control man access to the past literature on the pest, and enables the orderly recording of new data. Our most notable recent example of the role of taxonomy in economic operations is the identification of a single caterpillar from Orange County (California) in October, 1942, as the larva of the oriental fruit moth. There followed many meetings of fruit growers and entomologists consuming considerable time and traveling expense. The State Legislature appropriated over $850,000 for various phases of investigation and control. Between 500,000 and 600,000 moth specimens that were caught in the oriental fruit moth

traps were identified in order to segregate the actual oriental fruit moths and learn the range of that species in California. While the moth was discovered here too late to allow eradication, taxonomy has opened the way for control procedures and investigations before the pest has overrun commercal fruit orchards.

With the principal activity of applied taxonomy in mind, namely the dispensing of specific determinations, it follows that the next most important thing is that of seeking new and better methods for differentating species, and for the recording of new species—a large task. Increased knowledge on species differentiation has in recent years had a profound effect on the control of screw-worm flies, red, yellow, and related scales, tomato pinworm, and others. As little planning was done looking toward such results, we can only wonder how many more such things remain to be discovered by the chance of personal initiative.

The application of taxonomy to economic entomology has been, and is being, practiced in a very limited fashion. Not many tax-supported entomological organizations give it a definite place in their set-ups. It enters into the planning of almost no economic projects. Commercial insecticide organizations freely consult governmental taxonomists but assume no responsibility themselves for the development of knowledge on insect identification. Applied taxonomy is not taught anywhere as such. Aside from what research the man on the job can do himself, the most he usually obtains from outside sources is an occasional chance article which is partly useful.

The main reason our systematic data so often fails the applied taxonomist is that he must examine material and use techniques not popular with the usual taxonomist. This material consists mainly of species in the order Homoptera and of holometabolous larvae. While the source material in the Homoptera is in most respects fragmentary or preliminary from the applied viewpoint, one family of scale insects, the Diaspididae, has recently been well clarified. Let me point out that scales have perhaps more economic species than any other group of comparable size, and that the worker who has thus helped us is not employed by an economic organization.

It is in the research on and knowledge of immature forms that we find the most discrepancies in data available to the applied taxonomist. We have some valuable leads toward identi-

fying holometabolous larvae but most of them are barely introductory. Keys for identification of caterpillars by Fracker, for coleoptera larvae by Böving and Carighead, and for part of the more primitive maggots by Malloch, are among the best examples of comprehensive literature on holometabolous larvae. In many particulars the identification features of important immature stages are at best in the minds of but a few people. The medical side of applied taxonomy is probably in the best position, with considerable thoroughly-developed literature, especally on mosquitoes and their larvae. In contrast to this, in spite of all the years that the cotton boll weevil and relatives have been serious pests, we still have no careful analysis of the larvae of species in the anthonomine group. We know very little about immature Homoptera and Hemiptera. Immature stages, especally holometabolous larvae, are usually the ones found doing the damage, and their identification is the key to the situation, as pointed out in connection with the oriental fruit moth. This is vital to economic entomology, but there is no clearly-defined effort to do anything about it.

Research on new and better methods of species differentiation includes other activities as well as critical laboratory analytical methods. The collection and study of arthropods in the field by the taxonomist not only enables him to get adequate material, but gives him invaluable perspective on his work. This is true in regard to quarantined insects that do not occur in the area in which the applied taxonomist works, but the identification of which gives a meaning to legislative control. And, in order for the taxonomist to correlate the visble structures he studies with the habits or activity of the species, and to disclose the true nature of polymorphism, applied taxonomic studies should be conducted in connection with greenhouses and rearing rooms.

If we stopped our consideration of applied taxonomy right here, this branch of classification would be abundantly worthwhile. But there is more to it than that. The simplest way taxonomy aids insect control beyond species identification is by enabling the economic entomologist to borrow methods from the control of species similar to the one under suppression. An example would be the use of established scale control methods on new scale pests. Thus, taxonomy serves as an orderly basis for thinking, and correlates control methods. The spectacle of an economic entomologist fastening his attention entirely on one

species gives the impression that he will sooner or later be operating with a poverty of new entomological ideas. The codling moth control fraternity is perhaps the best example in this case.

Another way taxonomy can go farther than species naming is that of defining genera whenever possible, so that they not only have a structural significance, but also a bionomical or geographical aspect. Geographical considerations are of prime importance in parasite explorations. In this connection, biological control organizations seem to have neglected what we might term the "geo-taxonomy" of the insect groups that contain species they seek to control.

Taxonomy is primarily based on the comparison of arthropod structures. These structures are present because of some mechanical value to the individual arthropod. Structures are visible mechanisms, and the taxonomist, by comparing them, makes logical arrangements of these visible mechanisms. Important control methods are based on such things as oral mechanisms, skin structures, and gland secretions. These have definite places in taxonomy, which has a wealth of comparative data on such structures. It is of profound significance that serological studies indicate that the chemical similarities of arthropods closely follow their mechanical affinities.

Since taxonomy proceeds largely by the process of thorough comparison, therefore comparison is at the basis of taxonomic reasoning. With this fact in mind, let us momentarily analyze present practices in arthropod-control research. We immediately see a strong tendency to treat arthropod pest species as unrelated entities. For example, there are many articles in existence describing the reactions of one species of insect to numerous control chemicals. That is perfectly correct as far as it goes, but taxonomic reasoning indicates that if the reverse aspect of this is not also investigated the whole thing is lop-sided. In other words, the reactions of numerous arthropod species to single chemicals will give interspecific variations in reaction, and these variations can then be correlated with visible mechanisms and biochemistry. This does not imply that such a thing ought to be done in connection with each control project, but as a standard practice to give valuable data to control projects. The significance of the reciprocal toxicity of sulfur and cyanide to arthropods lacking or possessing spiracles would be a good subject for an in-

vestigation of this type. The chemical side of the problem is the "what" side; the arthropod side the "why" side. I am not referring in this case to attempts by insecticide companies to sell their products as cure-alls.

Remarks have already been made leading up to the statement that applied taxonomy needs some special literature. There is no better origin for such literature than with the applied taxonomists themselves who owe it to their profession to publish the identification problems they solve. The type of literature needed is not that which is illustrated by a photograph or general sketch, but by figures drawn on the basis of interspecific and intergeneric comparison, analyzing the body comprehensively. There is enough information in existence scattered through books and periodicals, preserved in collections, and in the minds of a few people, to form a valuable manual or manuals, on preparatory methods and characters for the identification of economic arthropods and near relatives. With this as a basis we could build further knowledge in a really effective form.

Let me conclude by repeating that the application of arthropod taxonomy to economic operations means restriction to study of pertinent arthropod groups. This taxonomy, as well as being restricted, has certain definite procedures and objectives, the most important objective being species identification. Applied taxonomy depends for its future development squarely on the intelligent support of the organizations that need it. While the economic value of taxonomy is conceded, there is a general passive policy, both expressed and implied, that the solution of pertinent taxonomic problems must be largely based on the chance coincidence of opportunity and ability or inclination. Amateur taxonomists have done important work, but economic entomology is a large and growing profession, and the amateur or passive slant on applied taxonomic development cannot assure such progress as is needed. Economic entomological organizations will find that the only effective applied taxonomy is that for which they are willing to be actively responsible.

IXODES NEOTOMAE, A NEW SPECIES FROM CALIFORNIA (ACARINA: IXODIDAE)[1]

BY R. A. COOLEY
Senior Entomologist, United States Public Health Service

A detailed study of numerous specimens of *Ixodes* which have the auriculae in the shape of a pair of long, curved horns shows that the form in California occurring mainly on the wood rat (*Neotoma*) differs from *I. diversifossus* Neumann, 1899 taken from the raccoon (*Procyon lotor*) in New Mexico, and *I. spinipalpis* Nuttall, 1916 which is found mainly on rabbits in the Western States. The California species is described below.

Ixodes neotomae Cooley, new species

Female

Body. No unfed specimens are available. Engorged females may reach at least 6.5 x 4.0[2] and are oval, wider and thicker (dorso-ventrally) behind.

Capitulum. Length (from tips of cornua to tip of hypostome) from 0.66 to 0.78; width of basis, 0.36 to 0.40. Lateral margins straight or a little curved, mildly converging posteriorly. Posterior margin straight, salient, and at about the same level as the distinct, small cornua. Surface mildly and evenly convex, faintly shagreened, impunctate, and without hairs. Porose areas well separated, superficial or faintly depressed. Palpi long, with lateral profile lines straight, curved on median side, widest at about the middle. Surface nearly smooth, shining; hairs few and short excepting a few long ones on the median side at the base. Combined length of articles 2 and 3 about 0.60, greatest width 0.158.

In ventral view basis is slightly waisted at the middle, posterior corners rounded and the posterior edge nearly straight and salient. Transverse suture faint or absent. Auriculae as long, curved horns which are directed downward and backward. Surface smooth, shagreened and shining. Palpi with their inner faces flattened. Article 1 with a distinct pointed ventral spur and usually with two fine hairs. Several long, fine hairs arising from the ventral edge of the palpi.

Hypostome. Long and narrow with the denticles 4|4, 3|3, and at the base 2|2; denticles long, narrow, and sharp, progressively smaller toward the middle line. Length about 0.405.

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[1] From the Rocky Mountain Laboratory (Hamilton, Montana) of the Division of Infectious Diseases of the National Institute of Health.

[2] All measurements in this paper are in millimeters.

Scutum. Length from 1.05 to 1.17, width 0.78 to 0.87. Oval, very broadly rounded behind. Lateral carinae as rounded elevations which may be nearly negligible in some specimens. Cervical grooves divergent, moderate or faint, and usually absent in the anterior area. Punctations distinct, larger, and more numerous in the median posterior area, few or absent outside of the lateral carinae. Surface shagreened and shining. Hairs long and fine.

Legs. Moderate in length and size, and with the ventral hairs long. Length of tarsus I, 0.48; metatarsus, 0.24. Length of tarsus IV, 0.39; metatarsus, 0.30.

Coxae. Flattened, shagreened, and with long fine hairs. Posterior margins salient posteriorly. Internal spur on I long; absent on II, III, and IV. External spur on I distinct but short, those on II, III, and IV progressively smaller and that on IV very small.

Spiracular plate. Nearly circular with the slightly longer axis trasnverse. Marginal goblets rectangular, medians circular and larger. Length 0.17, width 0.147.

Sexual aperture. At the level of the posterior edges of coxae III.

Male

Body. Length 1.02, width 0.72. Oval, widest at about the middle.

Capitulum. Length 0.326; width of basis 0.20. Sides nearly straight, converging posteriorly. Cornua distinct, small and at the level of the straight, salient posterior edge. Surface nearly flat, shagreened, impunctate, and without hairs. Palpi with their lateral profile lines nearly straight, median sides curved, widest well back of the middle. Surface smooth and faintly shining, depressed near their median margins. Hairs few and short excepting a few long ones on the median side at the base. Combined length of 2 and 3, 0.22; width 0.105. In ventral view basis is broad, rounded and salient behind; auriculae as short, pointed or rounded lateral extensions at the same level as the ventral surface. Palpi flattened on their inner faces. Article 1 with sharp ventral edge which is continuous with the ventral edge of articles 2 and 3. A few long hairs present on ventral edge of articles 2 and 3.

Hypostome. Large, mildly notched apically. Lateral denticles large and sharp, about four in number on each side, with one large, rounded tooth directed behind. Median denticles as diagonal crenulations or very faint teeth. Length about 0.216.

Scutum. Oval, convex, about equally declivitous in all submarginal areas. Lateral carinae absent. Cervical groves distinct but mild, divergent behind and reaching about half the length of the scutum. Pseudoscutum distinguishable mainly by its darker color; reaching about half the scutal length. Punctations distinct, smaller on the pseudoscutum. Surface shagreened, shining. Hairs long and fine.

Legs. Essentially as in the female. Length of tarsus I, 0.29; metatarsus, 0.144. Length of tarsus IV, 0.27; metatarsus 0.144.

Coxae. Essentially as in the female.

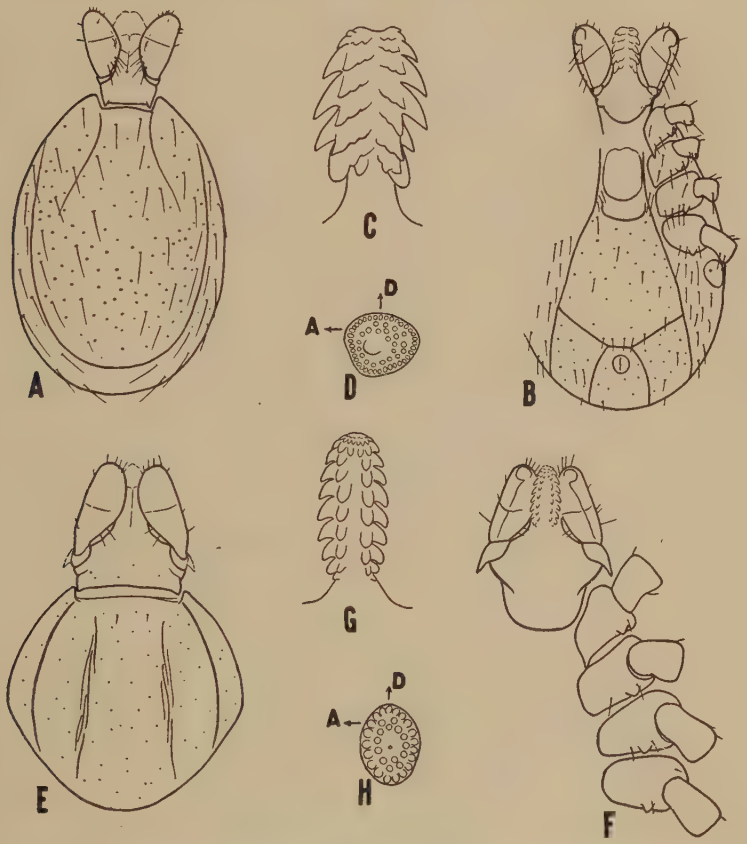

Fig. 1. *Ixodes neotomae* Cooley. *A.* Capitulum and scutum, male, dorsal view. B. Capitulum, coxae and ventral plates, ventral view. C. Hypostome, male. D. Spiracular plate, male. E. Capitulum and scutum of the nymph, dorsal view. F. Capitulum and coxae of nymph, ventral view. G. Hypostome, nymph. H. Spiracular plate, nymph.

Ventral plates. Median plate about three times as long as the anal plate. Adanals much wider in front. Anal plate much wider behind. Punctations on median and adanals small but distinct; absent or few and small on anal plate. Hairs few, fine and of moderate length.

Spiracular plate. Small, oval with the longer axis longitudinal.

Goblets about equal in the marginal and median fields, those in the median field few in number. Length 0.125, width 0.96.

Sexual aperture. At the level of the intervals between coxae II and III.

Nymph

Capitulum. Length (from tips of cornua to tip of hypostome), 0.34; width of basis, 0.29. Basis short and broad, flattened on top. Cornua short but distinct, a little elevated over the level of the posterior edge which is nearly straight, salient. Surface faintly shagreened, shining, faintly punctate and without hairs. Palpi short, with the lateral profile lines straight, median profile lines evenly curved. Surface smooth and shining; hairs few, short and fine. Combined length of articles 2 and 3, 0.15.

In ventral view basis is broad in front, narrow, evenly rounded behind, and slightly waisted at the middle. Transverse suture not visible. Auriculae only suggested as mild extensions at the same level as the ventral wall of the capitulum. Surface smooth, shining, impunctate and without hairs. Palpi set far away from the mouth parts, flattened medially. Article I with a conspicuous retrograde spur.

Hypostome. Bluntly rounded apically. Dentition 2|2 for most of the length. Laterals larger and only a little pointed; medians smaller and rounded. Length about 0.187.

Scutum. Length 0.60, width 0.63. Lateral carinae very distinct, more declivitous on the median side, the two limiting a median oval depressed area. Cervical grooves deep, long, nearly parallel, and reaching nearly to the anterior and posterior ends of the scutum. Surface faintly shagreened, shining, and with a few small punctations. Hairs negligible.

Legs. Essentially as in the adult.

Coxae. Much as with the adults but with internal spur on coxae I shorter.

Spiracular plate. Oval, with the marginal and median goblets of about equal size. Length 0.096, width 0.067.

Holotype. Two females (19430) from *Neotoma f. microtis*, November 5, 1941, Los Angeles County, California.

Allotype. One male (16831) from *Sylvilagus bachmani cinerascens*, October 7, 1922, La Jolla, San Diego County, California.

Paratypes. One female (15970), *Sylvilagus bachmani cinerascens*, September 17, 1922, Angels Camp, Calaveras County; one female (15811), *Neotoma fuscipes*, April 17, 1939, Monterey County, California; one nymph (17948), *Neotoma fuscipes*, July 13, 1940, Hastings Natural History Reservation, California; one female (12943), deer mouse, June 30, 1936, Oakland Hills, Oakland, California; three females (13064),

Sylvilagus sp., February 7, 1937, GOPHER CANYON, VISTA, CALIFORNIA.

Holotype, allotype, and paratypes 17948 deposited in the collections of the Rocky Mountain Laboratory, Hamilton, Montana.

Paratype 13064 placed in the United States National Museum; paratype 15811 in the Division of Entomology and Parasitology, University of California, Berkeley, California, paratype 15970 in

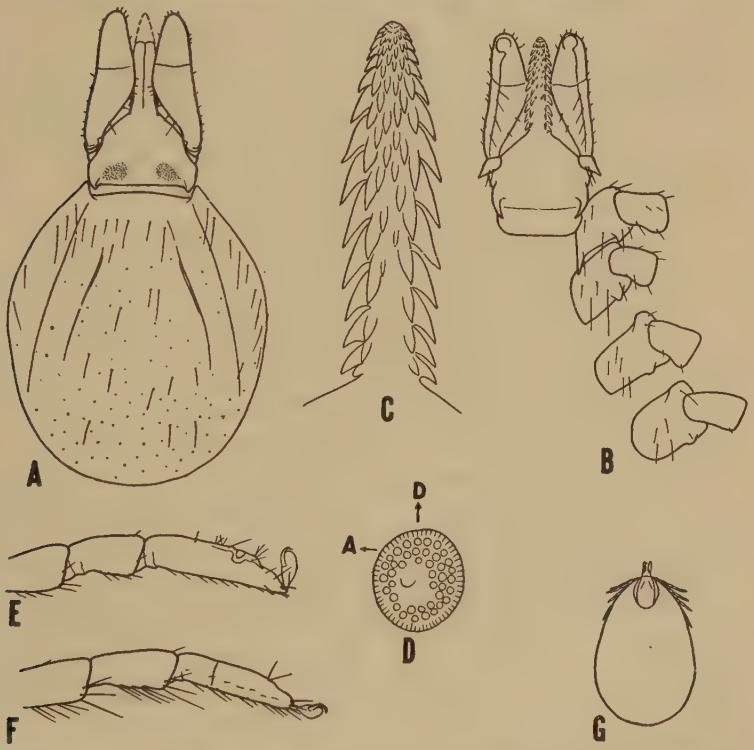

Fig. 2. *Ixodes neotomae* Cooley. A. Capitulum and scutum, female, dorsal view. B. Capitulum and coxae, female, ventral view. C. Hypostome, female. D. Spiracular plate. E. Leg I, female. F. Leg IV, female. G. Engorged female.

the Museum of Comparative Zoology, Harvard University, Cambridge, Massachussetts.

Females of *neotomae* are close to those of *spinipalpis* but can be separated by the narrower hypostome in *neotomae* which has longer, sharper denticles; *spinipalpis* has the sexual aperture between coxae IV, while in *neotomae* it is at the level of the

intervals between coxae III and IV. Adults, especially the males, are larger in *spinipalpis*.

The nymphs are very distinct, those of *spinipalpis* having the hypostome wider with the lateral teeth more pointed, and with the dentition 3|3 for nearly half the length and then 2|2, while in *neotomae* the hypostome is more rounded apically, with denticles more rounded; dentition 2|2 from near the tip to the base. The nymphal scutum in *neotoma* is nearly circular and has distinct curved lateral carinae, while in *spinipalpis* it is a little longer than wide and has shorter, nearly straight lateral carinae.

Both *neotomae* and *spinipalpis* are close to *diversifossus* of which no nymphs are known. *I. diversifossus* is distinctly larger and has the larger and heavier auriculae placed farther apart and has no definite ventral horn on palpal article 1.

A NEW SPECIES OF ZACOTUS

(Coleoptera, Carabidae)

BY F. W. NUNENMACHER
Piedmont, California

Zacotus fredericki Nunenmacher, new species

Elongate narrow and convex; metallic green, shining, under surface and legs shining black. Head a little smaller than prothorax, surface rugose, the longitudinal impressions clearly outlined; epistoma truncate, suture distinct; mandibles black; maxillary palpi stout, last segment truncate at apex; antennae thick, black. Pronotum almost as wide as long, sides arcuate and finely reflexed, surface with transverse rugulae; median stria deep; scutellum short and broad. Elytra twice as long as broad, one-fourth wider than pronotum, sides not quite parallel, a little wider at two-thirds of their length; apex evenly rounded, margins very finely reflexed; flanks with four or five impressed submarginal punctures; stria fine, not punctate; intervals flat, unevenly creased, without dorsal punctures; subscutellar punctures distinct, the short, feeble, and slightly oblique scutellar stria not strongly marked. Anterior tarsi of male dilated spongiose beneath, inner tibial tooth beyond the middle strong. Length of male, 15 mm., width at two-thirds its length, 4.5 mm.

Holotype male, *allotype* female, and two *paratypes*, collected by the writer in LINCOLN COUNTY, OREGON, on June 8, 1941. The holotype, allotype, and a female paratype remain in the author's collection. A paratype male has been deposited in the collection of Mr. E. R. Leach.

This fine species is dedicated to my son. It may be recognized at once by its metallic green color.

DESCRIPTIONS OF THREE NEW SPECIES OF *THRASSIS* JORDAN AND THE FEMALES OF *T. BACCHI* (ROTHS.) AND *T. PANSUS* (JORDAN)[1]

BY FRANK M. PRINCE
Assistant Entomologist, United States Public Health Service

Among the fleas collected by the field forces of the Plague Investigation Station, United States Public Health Service, in the course of investigating the distribution of Plague in the Western States, specimens of the genus *Thrassis* were obtained which are considered representative of new species. Females of *T. bacchi* and *T. pansus* which have not been described previously were also collected.

Thrassis setosis Prince, new species

Male and female. Frons with ocular row of 3 bristles, median bristle small; one small bristle above ocular row in the female and 2 in the male. The postantennal region of the head has a row of minute bristles along the border of the antennal groove in addition to 1 large bristle and a posterior row of 1 large and 2 small bristles. Labial palpi five-jointed and extending well beyond apex of trochanter as in *T. g. gladiolis* (Jordan).

Pronotal ctenidium with 16 or 17 spines. Apical spines on metanotum 2; abdominal tergites II, III and IV, 1 or 2.

Hind tarsal segment I equal to II, III and IV together.

Modified segments—Female. Antepygidial bristles 3, median one longest. Head of receptaculum seminis globular; tail short, broadest in distal half; similar to *T. g. gladiolis.* Sternite VII without sinus, there are 8 or 9 bristles on each side (fig. 6). Stylet one-half as broad as long and bears an apical bristle in addition to 2 lateral bristles.

Modified segments—Male. Antepygidial bristles 1. Tergite VIII with 8 or 9 large bristles along posterio-ventral border in addition to 5 large dorsal bristles. Manubrium dilated distally and truncated. Immovable process (P) of clasper dome-shaped, shorter than movable finger (F). Movable finger convex on posterior border and armed with 1 long bristle distally and 3 shorter pale bristles more proximally; apex with straight cut along anterior face and concave near base of finger on anterior border. Sternite VIII broad with sclerified line near ventral edge; armed with 4 or 5 apical bristles, 2 long subapical and 2 or 3 smaller bristles. Internal portion of sternite IX broadest near apex or dorsal end; proximal lobe broad and rounded with 3 large, flattened, dark spines near apex in addition to 1 or 2 pale bristles;

[1] From the Plague Investigation Station, San Francisco, California.

upper lobe broad with numerous pale bristles along posterior border and minute bristles scattered over entire lobe on anterior portion (fig. 5).

Length. Female, 2.4 to 2.7 mm., average 2.55 mm.; male, 1.96 to 2.07 mm., average 1.98 mm.

Type locality. Yuma County, Arizona.

Type host. *Citellus harrisii saxicola* (Mearns).

The holotype and allotype were collected 11 miles east of YUMA, YUMA COUNTY, ARIZONA, April 6, 1938.

Paratypes. YUMA COUNTY, ARIZONA, 5 females and 1 male from the type host. YAVAPAI COUNTY, ARIZONA, 42 females and 27 males from the type host and 2 females from *Citellus variegatus grammurus* (Say), 2 females and 1 male from *Neotoma lepida stephensi* (Goldman), 1 female from *Peromyscus leucopus arizonae* (Allen), 2 females from *Zapus*. sp.

The holotype and allotype are deposited in the collection of the United States Public Health Service Plague Investigation Station, San Francisco, California. Paratypes have been deposited at the University of California, Berkeley, California, the California Academy of Sciences, San Francisco, California, and the United States National Museum, Washington, D. C.

Thrassis aridis Prince, new species

Male and female. Frons with an ocular row of 3 bristles, the median one small; two small bristles dorsal to ocular row. The occiput bears along the border of the antennal groove a row of minute bristles and a large bristle opposite about the center of the groove and a posterior row of 4 bristles, the ventral one of which is large. Labial palpi five-jointed, extending to apex of forecoxae or slightly beyond.

The pronotal ctenidium has 15 to 17 spines. Apical spines on each side of metanotum, 2; abdominal tergites vary but usually I and III, 1, II, 2 in male; female I and II, 1. Tergites II to VII with two rows of bristles.

Hind tarsal segment I shorter than II to IV together.

Modified segments—Female. Head of receptaculum seminis longer than broad. Tail of receptaculum seminis long with tip well sclerified. Sternite VII with sinus, upper lobe small and attenuated (fig. 2). There are 7 to 10 bristles on each side of sternite VII. Stylet approximately three times as long as broad and has an apical bristle in addition to 2 lateral bristles.

Modified segments—Male. Manubrium of process gradually tapering from base to apex, curving slightly upward, resembling *T. fotus* (Jordan), but not as pointed. Immovable process (P) of clasper shorter than movable finger (F) with the apex pointed

posteriorly. The movable process nearly symmetrical and has 4 bristles on posterior border, basal 2 largest. Proximal lobe of sternite IX with 4 pale bristles. Distal lobe with numerous minute bristles. Parameres boot-shaped (fig. 1). Two long acetabular bristles.

Length. Female 2.02 to 2.52 mm., average 2.17 mm.; male 1.35 to 1.87 mm., average 1.69 mm.

Type locality. Pima County, Arizona, and Santa Cruz County, Arizona.

Type host—*Dipodomys merriami.* Holotype male was collected 15 miles northwest of Nogales, Santa Cruz County, Arizona. Allotype female was collected 13 miles north of Tucson, Pima County, Arizona, February, 1939.

Paratypes. Pima County, Arizona, 2 females; Cochise County, Arizona, 1 male and 1 female; Pinal County, Arizona, 3 females; Santa Cruz County, Arizona, 2 males; Greenlee County, Arizona, 1 male; all taken on the type host. In addition to those collected on the type host 2 males were collected in Greenlee County, Arizona, from *Neotoma lepida;* 1 male was taken in Mohave County, Arizona, from *Onychomys leucogaster;* 2 males were taken in Hidalgo County, New Mexico, 1 from *Onychomys leucogaster* and 1 from *Dipodomys ordii.*

The holotype and allotype are deposited in the United States Public Health Service Plague Investigation Station, San Francisco, California. Paratypes are deposited in the United States National Museum, Washington, D. C., and the University of California, Berkeley, California.

Thrassis campestris Prince, new species

This species is closely related to *Thrasssi aridis,* except for the modified segments.

Modified segments—Female. Tail of receptaculum seminis without sclerified tip; shorter and broader than *T. aridis.* Sternite VII with deeper and pigmented sinus (fig. 4). Stylet short, approximately one-half as broad as long, with an apical and 3 lateral bristles.

Modified segments—Male. Sternite VIII with 3 long and 4 short bristles. Proximal and distal lobes of sternite IX longer and broader than in *T. aridis.* Movable process of clasper same general shape as *T. aridis* but bears 7 bristles on posterior border. Only 1 long acetabular bristle (fig. 4).

Length: Female, 2.40 to 2.85 mm., average 2.60 mm.; male, 1.95 to 2.47 mm., average 2.16 mm.

Type locality. Hooker and Grant Counties, Nebraska.

Type host—*Dipodomys ordii.* Holotype male was collected 7 miles west of MULLEN, HOOKER COUNTY, NEBRASKA. Allotype female was collected 6 miles north of ASHBY, GRANT COUNTY, NEBRASKA.

Paratypes. GRANT COUNTY, NEBRASKA, 2 females and 5 males from *Dipodomys ordii* and 1 male from *Onychomys leucogaster;* HOOKER COUNTY, NEBRASKA, 2 males from *Dipodomys ordii* and 2 females and 3 males from *Onychomys leucogaster;* CHERRY COUNTY, NEBRASKA, 2 males from *Dipodomys ordii;* GARDEN COUNTY, NEBRASKA, 1 female and 1 male from *Dipodomys ordii* and 1 male from *Peromyscus maniculatus.*

In addition to the types and paratypes examined Mr. Glenn M. Kohls of the Rocky Mountain Spotted Fever Laboratory, Hamilton, Montana, sent me a large series collected by Mr. Frank B. McMurry, United States Fish and Wild Life Service, from *Dipodomys* in Harper County, Oklahoma.

The holotype and allotype are deposited in the United States Public Health Service Plague Investigation Station, San Francisco, California. Paratypes are deposited in the United States National Museum, Washington, D. C., and the Rocky Mountain Spotted Fever Laboratory, Hamilton, Montana.

EXPLANATION OF PLATE I

Fig. 1. Modified segments of *T. aridis* male. Fig. 2. Sternite VII and receptaculum seminis of *T. aridis* female. Fig. 3. Sternite VII and receptaculum seminis of *T. campestris* female. Fig. 4. Modified segments of *T. campestris* male. Fig. 5. Modified segments of *T. setosis* male. Fig. 6. Sternite VII and receptaculum seminis of *T. setosis* female. Fig. 7. Sternite VII and receptaculum seminis of *T. bacchi* female. Fig. 8. Sternite VII and receptaculum seminis of *T. bacchi* female.

Abbreviations: *F,* movable finger of clasper; *P,* immovable process of clasper; *Par,* paramere; *Rs,* receptaculum seminis; *st.* sternite; *M,* manubrium.

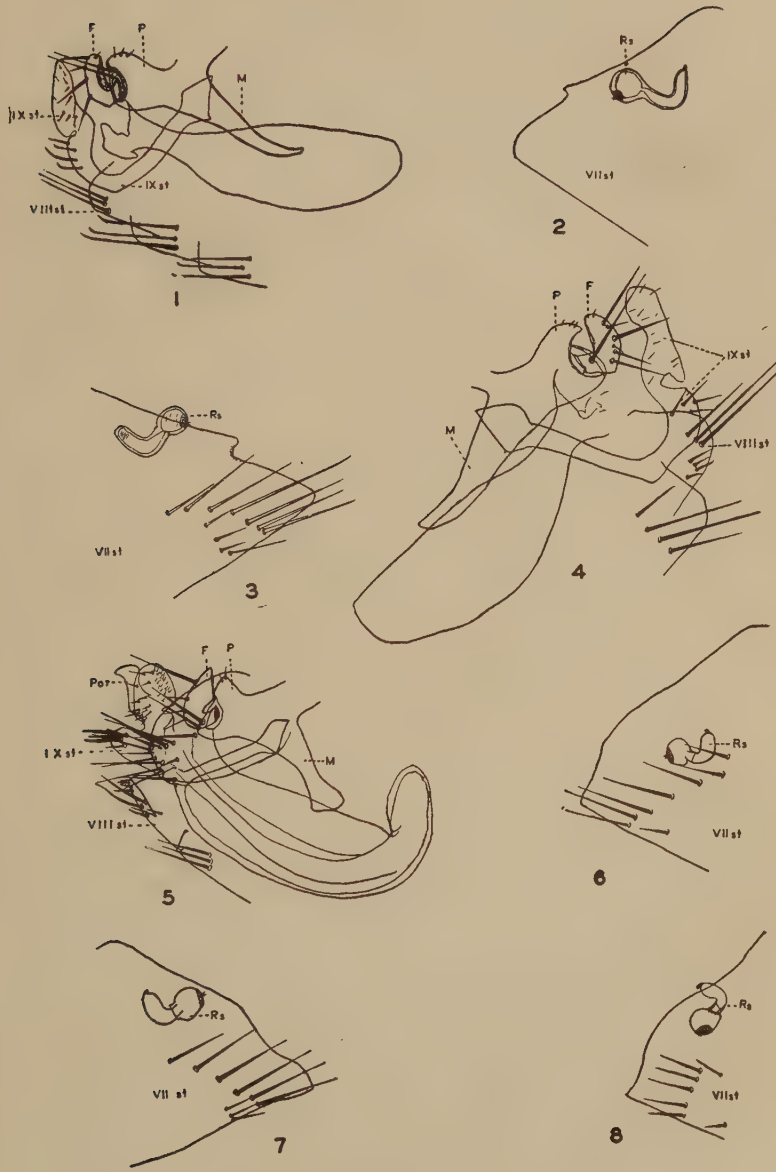
F
P
M
IX st
VIII st
1
Rs
VII st
2
P
F
IX st
M
VIII st
4
Rs
VII st
3
F
P
Por
IX st
M
VIII st
5
Rs
VII st
6
Rs
VII st
7
Rs
VII st
8

PLATE I

THRASSIS BACCHI (Rothschild) Jordan

Ceratophyllus bacchi Rothschild, 1905, Nov. Zool. 12:159-160.
Thrassis bacchi (Roths.) Jordan, 1933, Nov. Zool. 39:73.

Female—Head. On the preantennal region there are three bristles in the ocular row, median one small, in addition to 1 bristle near the oral edge. Postantennal region has a row of minute bristles along the antennal groove in addition to 1 large bristle.

Thorax. Pronotal ctenidium of 17 spines. Apical spines on metanotum, 1 on each side.

Abdomen. Apical spines on tergites II, III and IV, 1 on each side.

Modified segments. Receptaculum seminis and sternite VII as illustrated (fig. 7). Tergite VIII armed with 17 to 21 bristles. Stylet one-half as broad as long and bears an apical bristle in addition to 4 lateral bristles.

Length. 1.50 to 1.84 mm., average 1.58 mm.

Allotype female collected 5 miles south of GETTESBURG, POTTER COUNTY, SOUTH DAKOTA, from *Citellus tridecemlineatus* (Mitchill). Additional specimens were taken in POTTER and BROWN COUNTIES, SOUTH DAKOTA, from *Citellus richardsonii richardsonii* (Sabine) and in SPINK COUNTY, SOUTH DAKOTA, from *Citellus franklinii* (Sabine); in ROLETTE COUNTY, NORTH DAKOTA, from *C. r. richardsonii;* in BLAINE, PHILLIPS, VALLEY, DANIELS, ROOSEVELT and SHERMAN COUNTIES, MONTANA, from *C. richardsonii.*

THRASSIS PANSUS (Jordan) Jordan

Ceratophyllus pansus Jordan, 1925, Nov. Zool. 32:109.
Thrassis pansus (Jordan) Jordan, 1933, Nov. Zool. 39:73.

Female—Head. Preantennal region with ocular row of 3 bristles and 1 bristle dorsal to ocular row near oral edge. Postantennal region wth a single row of minute bristles along border of antennal groove in addition to 1 or 2 large bristles. Labial palpi five-jointed, extending well beyond apex of trochanter.

Thorax. Pronotal ctenidium of 17 spines. Apical spines on metanotum, 1 on each side.

Abdomen. Tergites II, III and IV 1 apical spine on each side, occasionally 2 on III. Tergites II to VII with two rows of bristles.

Modified segments. Head of receptaculum seminis globular and pigmented. Tail of receptaculum seminis broadest in distal half, sclerified tip. Sternite VII as illustrated (fig. 8). Tergite VIII bears 13 to 15 bristles. Stylet short, broad, with apical and 3 lateral bristles.

Length. 2.28 to 2.92 mm., average 2.66 mm.

Allotype female collected 14 miles northwest of LORDSBURG, HIDALGO COUNTY, NEW MEXICO, from *Onychomys leucogaster*. Additional specimens were taken in eastern ARIZONA, numerous locations in NEW MEXICO, and as far east as BREWSTER COUNTY, TEXAS. The type hosts are evidently of the genus *Citellus* and the subgenera *Ictidomys* and *Ammospermophilus*, whose range includes the area outlined. Specimens were also collected occasionally from *Peromyscus*, *Dipodomys*, *Neotoma* and *Cynomys*.

The writer wishes to express his appreciation to Dr. M. A. Stewart, University of California, Berkeley, California, for his suggestions and aid.

A NEW MOSQUITO RECORD FROM UTAH

(Diptera: Culicidae)

BY DON M. REES

University of Utah, Salt Lake City

In October, 1934, and April, 1942, the available mosquito records for Utah were published by the author in this Journal[1, 2]. The following constitutes a new genus and species record for the state.

MANSONIA PERTURBANS (Walker)

Utah: Ogden, Weber County, July 8, 9, 10, 16, August 11, 27, 1943 (Rees).

Adults of this mosquito, both males and females, were taken on the above dates on the Weber River directly south of Ogden in what is known as Riverdale. No larvae were collected, but conditions in the vicinity were suitable for their development.

Adults were collected at this locality in a light-trap, by hand while feeding, and in rabbit hutches and other out-buildings. The adults were fairly abundant but were more numerous in this locality during July than in August.

The author was unsuccessful in finding this species in other parts of Ogden or at several other localities along the Weber River that were inspected for this purpose; but undoubtedly this genus will be found to occur in other parts of the state as this work is extended.

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[1] Rees, Don M. 1934. Mosquito records from Utah. Pan-Pac. Ent., 10:161-165.

[2] Rees, Don M. 1942. Supplementary list of mosquito records from Utah. Pan-Pac. Ent., 18:77-82.

NOTES ON CANTHARIS, II
(Coleoptera, Cantharidae)

BY DOROTHY McKEY FENDER
McMinnville, Oregon

Cantharis dentatus Fender, new species

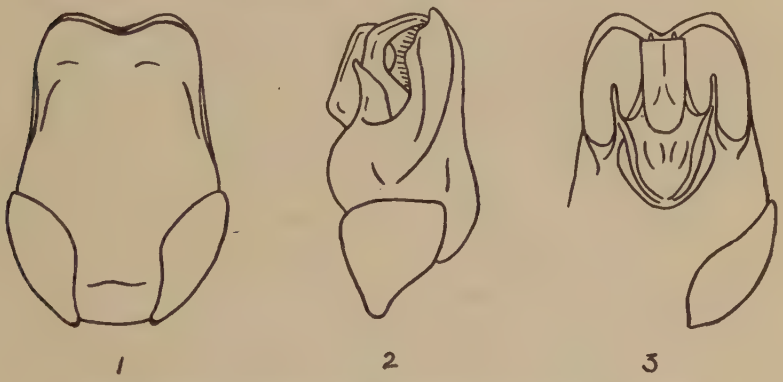
Black; thorax, head before the eyes, basal antennal joints beneath, and sides of abdomen testaceous; vestiture cinerous. Head finely, closely punctate posteriorly, virtually impunctate in the testaceous portion before the eyes; a median impressed line on the occiput. Eyes moderately small; about one-fourth the length of the head in the female, a little less than one-third the length of the head in the male. Mandibles dentate; armed with a single strong, rather blunt tooth on the inner margin of the apical third of each mandible. Antennae slender, subcylindrical, those of the female relatively shorter and stouter than those of the male; second joint about two-fifths the length of the third in the male, about one-half the length of the third in the female. Clypeus pyramidal, apex acutely emarginate. Thorax subquadrate; anterior margin evenly arcuate or with a very slight sinuation at apex (some females); anterior angles not prominent, obtuse; posterior angles subacute but blunt; disk nearly impunctate, with only a few fine scattered hairs, these more abundant anteriorly; side margins bordered by a definite, heavier marginal pubescence, blunt, especially anteriorly where the marginal pubescence is most abundant; rufotestaceous, a little darker on disk than at sides; thorax of female relatively shorter than that of male and broadest anteriorly, marginal pubescence less evident. Elytra rugose, with a soft, cinereous, primary pubescence, and stiffer, longer, black secondary pubescence. Tarsi moderately stout; anterior tarsi of male short and expanded. Anterior claw of protarsi of male cleft at tip, toothed at base, anterior meso-and metatarsal claws of male cleft at tip and with a blunt basal projection; anterior claws of all tarsi of female cleft at tip, toothed at base. Male genital armature; (figs. 1 to 3). Last abdominal sternite of female swollen either side of median line. Measurements: Length: Male overall 8 mm.; elytra 6 mm.; antennae 5 mm. Female overall 11 mm.; elytra 7.5 mm; antennae 5 mm. Width: Male elytra 2.5 mm.; thorax 1.5 mm. Female elytra 3.5 mm.; thorax 2.25 mm.

Holotype: male (Calif. Acad. Sci., Ent. No. 5404), California, C. W. Leng collection. *Allotype*: female (No. 5405), Kaweah, Tulare County, California, April 12, 1931, collected by Roy Wagner. Specimens examined, five males and four females. California: Otto Lugger collection; three specimens Kaweah, Tulare County, April 12, 1931, collected by Roy Wagner; Kern-

ville, May 7, 1931, collected by A. T. McClay; two specimens, Sequoia National Park, June, 1937, collected by F. T. Scott.

This species has long been confused with *Cantharis lautus* Lec. because of the fact that LeConte's type series of *C. lautus* is a species complex. *Lautus* was described in 1851, from a unique female with yellow legs. Later, LeConte associated a black-legged male with the type of *lautus* and subsequent references to *C. lautus* were rather to this male. Thus, for many years, *C. dentatus* has been determined as *lautus*, which is apparently a much rarer insect.

Mr. C. A. Frost very kindly compared the types of *C. dentatus* with LeConte's type series of *lautus* and concluded that it is "the same as the male associated with the type *lautus*" (*in litt.*). The



Male genital armature of *C. dentatus* Fender. 1, dorsal; 2, lateral, and 3, ventral view.

female type of *lautus* does not have the last abdominal sternite modified as in this species.

Lautus belongs with the *notatus*, *perpallens*, *ingenuus*, and *ochropus* group, whereas *dentatus* belongs with *divisus*, which also has the mandibles dentate. From *divisus* it may be easily distinguished by the immaculate thorax, and cinereous vestiture (golden in *divisus*), and from all other species by the ungual formation. The blunt basal projection of the anterior claws of the meso- and metatarsi of the males may, in some lights, almost appear to be a definite tooth (as is found in *divisus*), but in no case does it appear to be as acute as the basal tooth of the other ungues. I have seen a few females of *divisus* having the thorax immaculate, but from these, *dentatus* females may be distinguished by the peculiar formation of the last visible abdominal

sternite. The pronotal pubescence in these species consists of long, fine hairs each set in a very fine puncture.

Grateful acknowledgment is made to Mr. C. A. Frost for his comparison of this species with the type of *lautus* Lec. and to Mr. J. W. Green for the loan of the specimen from Kernville, California, and for his having called the author's attention to the fact that this species has the mandibles dentate, as in *divisus*.

LIST OF SIX SPECIES OF GYRINID WATER BEETLES COLLECTED BY J. L. GRESSITT IN CHINA AND JAPAN.[1]

(Coleoptera, Gyrinidae)

BY HUGH B. LEECH
Vernon, British Columbia

In 1938 some gyrinids were obtained from Mr. J. Linsley Gressitt of the University of California, Berkeley. The beetles were later submitted to Dr. G. Ochs, authority on the Gyrinidae of the world, and his identifications are as follows:

Dineutus landaisi latilimbus Ochs.
Ta Han, Hainan Island, June 2, 1935.
Dwa Bi, Hainan Island, July 20, 1935.

Dinetus orientalis Modeer (= *marginatus* Sharp).
Takayama, Japan, August 5, 1930.
Iriomote Island, Loochoo Islands, August 20, 1934.

Dineutus mellyi Régimbart.
Mizuho, Formosa, April 22, 1932.
Tsin Leong San, E. Kwantung, S. China, June 3, 1936.
Yim Na San, E. Kwantung, S. China, June 16, 1936.
Ta Au Hong, S. Kiangsi Prov., S. China, July 5, 1936.

Gyrinus orientalis Régimbart.
Tsin Leong San, E. Kwantung, S. China, June 2, 1936.
Foochow, S. E. China, July 30, 1934.
Hong San, S. E. Kiangsi Prov., China, June 26, 1936.

Orectochilus nigroaeneus Régimbart.
Yim Na San, E. Kwantung, S. China, June 14, 1936.

Orectochilus melli Ochs.
Tsin Leong San, E. Kwantung Prov., S. China, June 5, 1936.

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[1] Contribution No. 2264, Division of Entomology, Science Service, Department of Agriculture, Ottawa, Ont.

NEW SPECIES OF BOLETOBIUS FROM THE NORTHWEST WITH A DISTRIBUTIONAL NOTE ON COPROPORUS

(Coleoptera, Staphylinidae)*

BY BORYS MALKIN
Eugene, Oregon

During the course of an attempted monographic study of the Northwestern forms of the Staphylinid genus of *Boletobius*, several new species came to the writer's attention. While the whole work as originally conceived may not be completed for some time, due to present conditions, it seems worthwhile to present at least the descriptions of these new forms.

Boletobius kremeri Malkin, new species

Dark, piceous beneath, femora and tarsi yellow; head black, highly polished glabrous; maxillary and labial palpi pale yellow; third joint of the former short, pubescent. Thorax black; elytra red; abdomen piceous except last segment and posterior portion of the penultimate one which are red. Antennae: two basal joints pale yellow, 7-11 dark piceous. Joints 8-10 transverse. Thorax highly polished with setae bearing punctures on each side. Elytra: with three irregular dorsal rows of punctures with seta in each. The lateral row with 10 punctures, the middle with 9, some of which are obscured, the inner one with 7. Lateral elytral margins with a row of small spinules. Abdomen: black. First two segments polished on disc punctured on sides; the remainder of the segments with a long hairs. Punctures of the sixth segment very coarse, prolonged; fifth segment nearly twice as long as sixth anterior half distinctly darker. Margins of the segments with a long spinules increasing in size toward apex. The broad, lateral margins of the segments decreasing inward toward the apex, completely absent on the last segment. Ventral surface black. Margins of the epipleura castaneous. Legs dark yellow slightly paler toward the tarsi. Posterior half of the fifth segment and the entire sixth chestnut. Punctures very coarse prolonged. Trochi of the first pair of legs piceous. Femora with a dark cloud. Trochi, femora, tibia sparely punctured and muricate. Abdomen with the long fimbria along the sides and on the lateral portion of the segments, the largest at the posterior angle. Length, 8.2 mm.; width, 2.3 mm.

Male. Fifth segment with a small granulated area, feebly emarginate. Sixth, deeply, longitudinally impressed in the middle.

Female. Last segment simple.

Holotype, male, EUGENE, LANE COUNTY, OREGON, March 29, 1942 (B. Malkin & John S. Sadler). Allotype, female, BOYER,

* A contribution from the Zoological laboratory of the University of Oregon.

LINCOLN COUNTY, OREGON, April 25, 1936 (K. M & D. M. Fender). Paratypes: 1 male, GLENADA, LANE COUNTY, OREGON, September 14, 1941 (collected by the author from *Boletus* sp.). One male, BOYER, LINCOLN COUNTY, OREGON (K. M. & D. M. Fender), 1 male, April 11, 1936, same locality (K. M. & D. M. Fender). One female, labeled; SEATTLE, WASHINGTON, without any other data, from Hatch collection.

The type material is distributed as follows: holotype, allotype and Glenada paratype in author's collection. Two paratypes in Fender's collection. The Seattle paratype in Dr. Hatch's collection.

This species runs in Horn's key to *intrusus* from which it differs having only 8-10 antennal joints transverse, 3 discal rows of punctures instead of one, coarser puctulation on the dorsal side of the abdomen and different coloration of the last two segments. It is also considerably larger than Horn's species.

This species is named after Mr. Jean H. Kremer of New York City, with whom the writer has spent many days in the field.

Boletobius ruber Malkin, new species

Reddish, shining, legs testaceous. Head: black, moderately elongate, highly polished, widest at base. Maxillary palpi testaceous; fourth joint short, conical, shorter than third; the first three sparsely pubescent. Antennae, as long as thorax and head. Basal joints testaceous, 5-11 piceous. Joints 6-10 very strongly transverse. Thorax highly polished, wider than long, with sides gently rounded. Disc of thorax reddish-piceous, margins reddish-testaceous, median line feeble. Elytra yellow-reddish slightly longer than wide, polished, very minutely, transversely alutaceous. The black spot in the posterior half not attaining the suture or the apical margin of the elytron. Elytral rows of punctures distributed thus: discal with 5 distinct, sutural with 7 somewhat less impressed, reaching the sides of the scutellum, lateral with 8-10. Abdomen red, except last two segments which are darker. Apical portion of all segments paler, all deeply impressed near the anterior margin. Surface polished very minutely alutaceous, deeply and distinctly punctured, with yellow short hairs throughout and longer dark spinules in the lateral portion of the last two segments. Undersurface reddish-piceous. Episterna sparsely, minutely punctured, with a tiny hair in each puncture. Abdominal segments, coarsely, unequally punctured. Apical portion of tibia with short, unequal spinules. Length, 5 mm.; width, 1.3 mm.

Male. The penultimate segments slightly, narrowly impressed in the posterior half. Last segment with granulated area divided in apical half.

Female. Last segment simple.

The coloration of the last two segments varies in the specimens on hand from reddish to piceous, but the two last are always darker than the others. The punctulation also varies slightly in the intensity, usually and stronger on the last two segments.

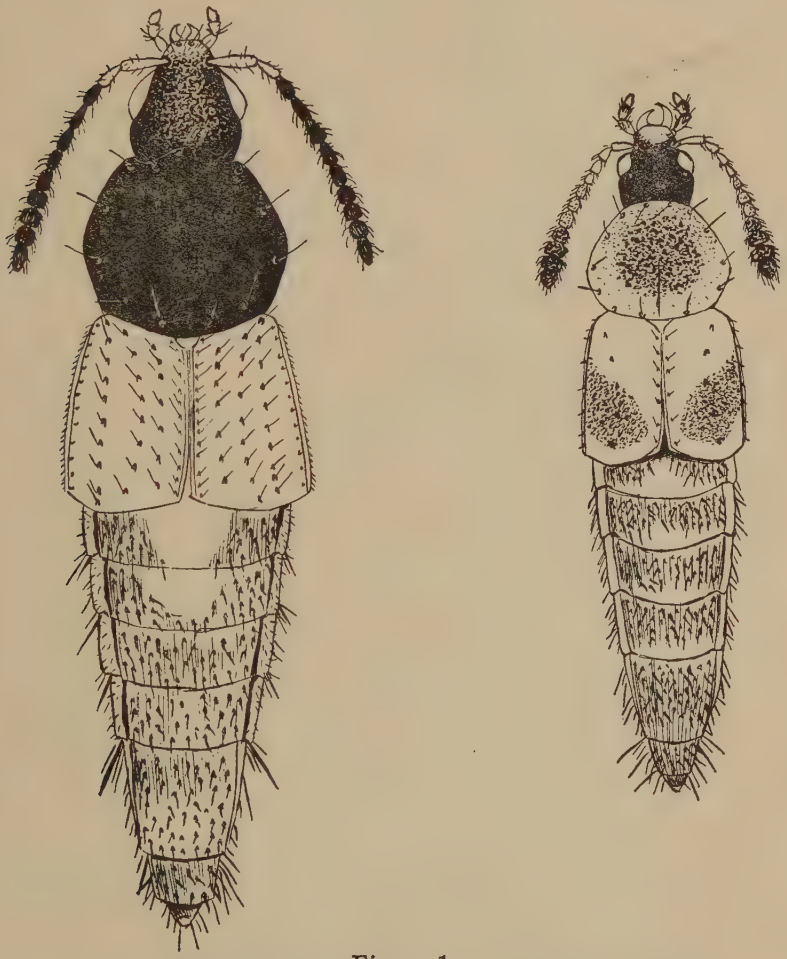

Figure 1
Boletobius kremeri Malkin, left; *B. ruber* Malkin, right.

Holotype, male and allotype, female, No. 5267, Aspen Grove, B. C., 22.V.1934 (collected by H. B. Leech under bark of *Pinus ponderosa*), in the Canadian National Collection. Paratypes: 2 males and 1 female the same data; 1 male, 3.V.1934, 1 female 7.V.1934, 1 female 14.V.1934, all from the same locality (H. B.

Leech, collector). One male, PENTICON, B. C., 4.V.1936, (McDonald, collector). One female, WINNIPEG, MANITOBA, 4. VI. 1912 "from under bark of poplar tree at night" (J. B. Wallis, collector).

Paratypes deposited as follows: 1 in the collection of the California Academy of Sciences, 1 in J. B. Wallis' collection. The remainder equally distributed between the collections of Mr. H. B. Leech and that of the author.

This species seems to have its closest relative in *dimidiatus* Er. from which it can be easily separated by reddish color of the entire body, deeper punctulation of the abdominal segments, joints 6-10 strongly transverse, more distinctly impressed sutural, elytral punctures and thorax more broadly margined with paler band. In Horn's key it should be placed between *dimidiatus* and *intrusus*.

Boletobius kelleyi Malkin, new species

Color in general reddish-testaceous. Head black, twice as long as wide, highly polished with sparse, minute punctures. Maxillary palpi yellow, strongly prolonged. Fourth joint as long as the third. First minutely pubescent, second and third with tiny hairs in their apical portion. Antennae: four basal joints testaceous, 5-11 piceous, all longer than wide. Thorax wider than long, regularly curved on sides, highly polished reddish-testaceous in color with disc somewhat clouded and paler margins. Median line short, feeble. In the front near the anterior margin two small, triangular spots on each side. Elytra as long as wide. Two spots and transverse area around scutellum black. Dorsal series of elytral punctures with 6, sutural with 7 less distinct. Lateral row with 10 punctures. Abdomen reddish-castaneous except for the anterior portion of the fifth segment which is black. Segments feebly impressed and very sparsely punctured. Pubescence sparse, yellow. Hairs longer on the lateral portion of the segments. Lateral spinules short. Ventral surface: legs, femora, tarsi, tibia testaceous. Epipleura black, similarly punctured as in *canadensis*. Episterna alutaceous with large, shallow punctures. Abdominal segments similarly colored as on the dorsal side, but strongly and closely punctured. The punctures feebler and sparser on the last two. Length, 6.5 mm.; width, 1.9 mm.

Type No. 5266, TRINITY VALLEY, B. C., 26.VI.1937 (H. B. Leech, collector), and 1 paratype, LANGLEY, B. C., 26.VI.1932 (K. Broham, collector), both of undetermined sex in the Canadian National Collection.

In the Horn's key *B. kelleyi* runs to *longiceps* Lec. It can be distinguished from the latter species by: much paler coloration of the entire body with only small portion in the apex black,

presence of the two dark spots on thorax and the presence of the distinct black area around scutellum.

Variation: In the paratype the abdominal segments are slightly darker, while the scutellar area forms a triangle, whose lateral sides do not reach the margins of the elytra.

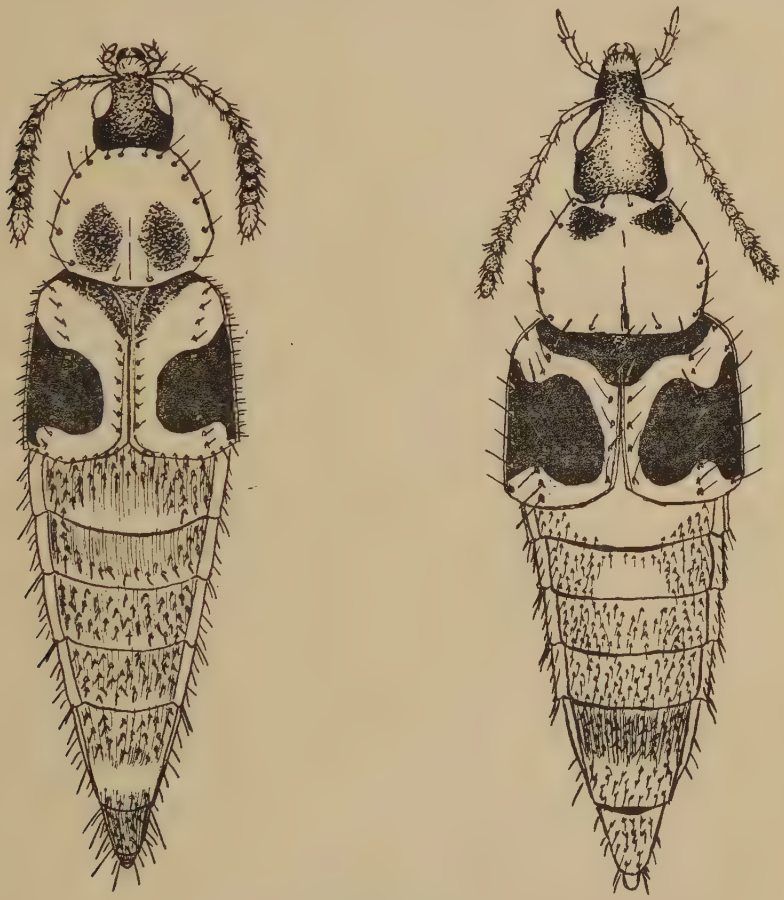

Figure 2
Boletobius cascadensis Malkin, left; *B. kelleyi* Malkin, right.

The species is named after Mr. Donald Greame-Kelley of New York City.

Boletobius cascadensis Malkin, new species

Head oval, highly polished, slightly longer than wide. Maxillary palpi yellow. Second joint as long as the third. The first three

pubescent. Antennae nearly as long as head and thorax. Basal joints testaceous, 5-11 piceous. Joints 6-10 slightly longer than wide, cup shaped. Thorax wider than long, regularly rounded, yellow, with a median dark line, and a well defined dark spot on each side of it. Surface polished, very minutely punctured, and almost invisibly, transversely alutaeceous. Elytra as long as wide, with a large variable black spot. The black area not attaining the sutural line or the posterior angles. Scutellum surrounded by the triangular black area. Disc with a series of feeble impressions. Dorsal series with 9 feeble, setae bearing punctures. Sutural with 10 still weaker, lateral width 7-9. Abdomen piceous with tips of segments paler. The yellow area on the fifth segment broader than on the rest, occupying almost four-fifths of the entire segment. Surface polished, alutaceous, sparsely punctured. Pubescence yellow, short. Lateral spinules short. Ventral side: mesosternum and episterna pitchy black. Epipleura black, with a row of regular, deep punctures in its anterior portion. Side pieces of metasternum regularly reticulate with a delicate, dark pubescence. Abdomen similarly colored as on the dorsal side, closely regularly punctured. The punctures prolonged, deep and distinct. Length, 6 mm.; width, 1.7 mm.

No secondary sexual characteristics determined.

Type and 3 paratypes, Scott Lake, one mile north of McKenzie Pass, LANE COUNTY, OREGON, altitude 4,800 feet, August 17, 1941, taken by the author from decaying *Boletus* sp. 1 paratype, GRANITE, BAKER COUNTY, OREGON, June 15, 1941, K. M. & D. M. Fender, collectors.

Type and 2 paratypes in author's collection, 1 paratype in the collection of the California Academy of Sciences, 1 paratype in Fenders collection.

This species is very closely related to *B. anticus* Horn and it has probably been mistaken for that species in collections. It can be separated from the latter by having the thoracic spots posteriorly located instead of anteriorly, much broader yellow area on the fifth abdominal segment, and a very coarse punctulation on the ventral side of the abdominal segments.

The specimens on hand exhibit very little variation except for the extent of the elytral spot and the number of punctures in the lateral row. The dorsal row is quite uniform as well as the extent of the thoracic spots.

Boletobius cascadensis hatchi Malkin, new subspecies

Head oblong oval, black, shining. Maxillary palpi yellow all joints of nearly equal length. First two delicately pubescent. Thorax slightly wider than long; red, with disc indefinitely

clouded, polished, very delicately, transversely alutaceous. Elytra as long as wide, polished. The black spot variable in size somewhat posteriorly located, not attaining the suture. Dorsal series irregular, usually of 9 punctures, sutural of 10, lateral 8-10, irregular but distinct. Abdomen piceous, segments broadly yellow in the apical, posterior portion. Yellow area of fifth segment occupying the entire apical half. Punctures sparse but distinct with the golden pubescence. Surface transversely alutaceous. Lateral spinules short. Ventral side: femora, tarsi, tibia red-testaceous. Epipleura black, except in the apical portion where they are reddish-testaceous. Mesosternum and metasternum as in *kelleyi*. Color the same as on the dorsal side. Segments very coarsely punctured, thickly pubescent. The punctures on the last two segments feebler toward the apex. Length, 3.5 mm.; width, 1.25-1.6 mm.

Type and 26 paratypes of undetermined sex collected by M. H. Hatch on Mt. Bonaparte, Washington, July 12, 1931.

Type and 17 paratypes in Hatch collection. Four paratypes in author's collection. One paratype each in the collections of: California Academy of Sciences, Oregon State College, K. M. & D. M. Fender, C. A. Frost, and H. B. Leech.

The series studied vary greatly in size and in coloration, particularly in the extent of the elytral spot and in coloration of thorax. In some specimens the latter is almost piceous on the disc, but the margins are usually more pale in all specimens.

This form differs from *cascadensis* by having the epipleura black in the posterior half, more conspicuous pubescence on maxillary palpi, absence of a definite pattern on thorax and considerably smaller in size and more robust body.

B. cascadensis subsp. *hatchi* is undoubtedly, like the original form, mistaken in the collections for *B. anticus*. In Horn's key it should be placed between *cascadensis* and *pygmeus* Fab. At present time the writer considers *hatchi* as a subspecies but it is quite possible that in the future it will be separated as a distinct species.

Boletobius intrusus wallisi Malkin, new variety

This form resembles the original form very closely except for the following differences: Smaller size, abdomen of much paler color and more coarsely punctured surface of the abdominal segments. Length, 5 mm.; width, 1.5 mm.

Holotype, male and allotype, female, No. 5268, Winnipeg, Manitoba, 27.VI.1915, in the Canadian National Collection, both collected by Mr. J. B. Wallis.

COPROPORUS VENTRICULUS (SAY)

In Dr. Hatch's collection of *Tachyporini* a specimen of *Coproporus ventriculus* (Say) has been found taken at Pierce, Idaho, on July 27, 1939. This is apparenty a new record for the state. Blackwelder in his revision of the genus* lists Oregon, Nevada, Washington and California and several Eastern and middle-western states as habitat of the species, but does not mention any Idaho records. There are also in the same collection 16 old specimens labeled "Seattle, fungus" which confirms its presence in that state. In spite of the literature records, this only representative of the genus seems to be not common in the Northwest. The present writer has never been able to find any in Oregon, nor was he able to discover any in the Oregon collections as well as in other collections from the Northwest which he examined.

Acknowledgments: In addition to writer's own collection the following individuals contributed material for study through loan: Mr. H. B. Leech, Mr. J. B. Wallis, Dr. Melville H. Hatch, Professor James N. Macnab, Mr. and Mrs. Kenneth Fender, and Mr. L. G. Gentner. Thanks are also due to Mr. R. L. Post, curator of the entomological collection at Oregon State College, for the loan of certain material in his custody and to Mr. J. L. Shuh for the loan of the *Boletobius* material from his collection. The writer is also indebted to Dr. W. J. Gertsch of the American Museum of Natural History, to Dr. D. C. Mote of the Oregon State College, and to Mr. H. B. Leech for the help with certain literature, and to Miss Edith Onthank, a student at the University of Oregon, for drawings and assistance.

SPRING FLIGHT OF ATIMIA DORSALIS (COLEOPTERA, CERAMBYCIDAE)

Atimia dorsalis LeConte is common in southern British Columbia, where it breeds in western red cedar, *Thuja plicata.* It is the first longhorn to appear on the wing each spring ,and many individuals are abroad by mid-April. My earliest record is for March 20, 1932, on which date my brother, Geof. B. Leech, took a specimen flying, at Salmon Arm.—HUGH B. LEECH, Vernon, B. C.

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* R. E. Blackwelder. 1938. "Revision of the N. A. Coproporus." Proc. U.S.N.M. 86, 1-10.

SYSTEMATIC NOTES CONCERNING AMERICAN ACRAEINAE, II

(Lepidoptera: Nymphalidae)

BY ROBERT W. L. POTTS

University of California, Berkeley

This article, with a previous one[1] makes available the principal changes and additions to the genus *Altinote* resulting from preliminary studies for a proposed revision of the American Acraeinae.

I should like at this time to express my grateful appreciation to E. Gorton Linsley; to Wm. T. M. Forbes for the loan of material from the Cornell University collection; to Lawrence S. Dillon for the loan of material from the collection of the Reading Public Museum; and to Charles D. Michener for the loan of material from the collection of the American Museum of Natural History.

Altinote (Abananote) carmentis Potts, new species

Male. Dull black with faint whitish gloss. Forewing above marked only by red-orange streak in subcostal cell similar to that in *erinome*, and by a series of five light buff spots beyond cell between veins, traces of buff near anal angle and above radius; first three spots nearly equal-sized, ovate; fourth much larger, subtriangular with long point toward outer margin; fifth smaller, elliptical. Hindwing unmarked.

Underneath buffy-grey with first four buffy spots coalesced in a band, fifth spot slightly separated; orange subcostal streak repeated; apex with faint, even intervenal stripes. Hindwing evenly striped, slightly darker at outer margin.

Forewing (base to apex) 23 mm., total expanse 43 mm.

Holotype male from MOYOBAMBA REGION, PERU, December 15, 1925, from the Bassler collection in the American Museum of Natural History.

Very similar in appearance to the female of *euryleuca*, but the band of spots entirely beyond the discal cell by about one-half the length of the first of the buff spots. Shape and size, as well as the red-orange stripe, are suggestive of *erinome*.

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[1] Potts, Robert W. L., Systematic Notes Concerning American Acraeinae, Pan-Pac. Ent., 19(1):31-32, January, 1943.

Altinote (Altinote) alcione mengeli Potts, new subspecies

Male. Brown-black, more to black; similar to *sodalis* except forewing with basal area extended outwardly, orange, the orange apical band very narrow and not above radials, of three or four obsolescent spots; dark discal band widened, directed toward point slightly above anal angle.

Similar underneath; hindwing with color striping much reduced, yellow-orange at base; greyish band barely apparent on disc; striping between dark venal-intervenal stripes mainly brownish.

Forewing 26.0 mm., expanse 49 mm.

Holotype male from JEPELACIS, PERU, without further data, in the Mengel collection of the Reading Public Museum. One paratype from Jepelacis and another from RIO HUALLAGA, ACHINAMIZA, PERU, also in the Reading collection. Two *paratypes* in the author's collection, one from Jepelacis and one from INCA PECHETEA, PERU.

Similar to *sodalis*, but distinguished from it by the obsolete apical band, the heavier discal band, and the greater extent of the basal area. Variation of forewing in the paratype series is from 22.5 mm. to 26.0 mm.

Altinote (Altinote) alcione bassleri Potts, new subspecies

Male. Dark brownish. Forewing above with basal area pale orange, almost without reddish tone, extended to include lower angle of cell and spot in cell M_3, with less than normal basal infuscation; apical band scarcely indicated; discal band not black, but dark brownish, only barely perceptible. Hindwing without marking.

Forewing beneath similar to upperside, weakly striped in costal area, hence this more a dark stripe than normal, color striping in apex nearly absent; apical band very narrow, entirely between Rs and M_2 or M_3. Hindwing beneath very weakly striped, orange virtually absent, greyish band barely, if at all, apparent.

Forewing 22.5 mm., expanse 42 mm.

Holotype male and three *paratypes* from MOYOBAMBA REGION, PERU, with no additional data; holotype and one paratype in the Bassler collection of the American Museum of Natural History, the other two paratypes in the collection of the author.

Similar in appearance to *mengeli*, but conspicously smaller, paler, and with somewhat more striped appearance beneath. Size variation of forewing from 20.5 to 22.5 mm. in the short series available for study.

Altinote (Altinote) alcione moneta Potts, new subspecies

Male. Dark brownish-black; forewing above closely similar to *mengeli,* but basal area red-orange, not so extended and scalloped at veins at outer margin; apical band absent; discal band directed to well above anal angle.

Beneath similar; discal band almost parallel to inner border in first half thence sharply angled toward anal angle, barely exceeding Cu_2, not extending into normal dark outer border; apical band very narrow, yellowish at outer edge; apex weakly striped, ground tone blackish. Hindwing more regularly striped than other *alcione* forms, yellow at base not strong, orange tinted, nebulous dark area at end of cell barely apparent, greyish discal band weak, tinted orange; dark outer border not strong; ground tone strongly blackish.

Forewing 26.0 mm., expanse 45 mm.

Holotype male, in the collection of the American Museum of Natural History, from 2-4° S, 78° W., ECUADOR. *Paratype* with similar data in the author's collection.

Altinote (Altinote) alcione hermosa Potts, new subspecies

Male. Brown-black, closely similar to *sodalis,* with normal basal area, medium discal band, comparatively extensive apical band, but color of basal and apical bands rose-orange.

Forewing 24.0 mm., expanse 45.0 mm.

Holotype male from HERMOSA, 1600 M., PERU, May 6, 1935, in the author's collection.

Easily distinguished from all but the following subspecies and *incarum* by the rose color; distinguishable from *incarum* by the presence of the apical band, and from the next subspecies by the opacity of the colored areas.

Altinote (Altinote) alcione leucothoe Potts, new subspecies

Male. Similar to *hermosa,* except apical band longer, discal band somewhat more curved, directed more toward anal angle; basal area and apical band rose-orange, more rose than *hermosa,* and basal area in particular semi-transparent.

Forewing 24.0 mm., expanse 45.0 mm.

Holotype male and seven *paratypes* from region of IQUITOS, PERU, according to data received. I should not be surprised, however, if the locality were farther to the west.

Paratype variation exhibits a widening of the dark discal band, some variation in transparency from a specimen in which the pin label may be read through the basal area to translucence.

The specimens are not rubbed, but fresh and in excellent condition. Easily distinguished from *hermosa* by this transparency.

In my opinion this series of *alcione* subspecies are more nearly genetic varieties, but without a considerably greater amount of material to study it seems better to conform to the usual practice and give names to the recognizable forms. It is my belief that it will be found that virtually every range and valley from Colombia to Bolivia will exhibit a slightly different *alcione* form readily distinguishable by the student from series collections, but difficult to describe or key out.

Altinote (Altinote) ozomene alicunde Potts, new subspecies

Male. Black with green irridescence over entire ground surface; larger than typical *ozomene*, otherwise similar.

Forewing 28.0 mm., expanse 54.0 mm.

Holotype male and two *paratypes* in the author's collection, from COLOMBIA, probably taken in February or early March, locality unknown, but believed to be near Queremal or Buenaventura, altitude about 3000 to 4000 meters.

The principal differences between this and the typical are in the definitely greenish irridescence, whereas the typical usually runs to purplish blue, never more than slightly greenish blue, and in the considerably larger average size, one paratype being slightly smaller, the other slightly larger than the type.

Altinote (Altinote) stratonice albunea Potts, new subspecies

Male. Similar to *aereta*, but with dark discal spots heavier above and forming an entire band both above and beneath; basal colored area almost eliminated by dark suffusion from base. Basal area beneath without suffusion. Disco-apical band light orange above, buffy underneath.

Forewing 24.0 mm., expanse 44.0 mm.

Female. Similar but larger, grey-black, with colored area proximal to transverse dark band clearly indicated, distally buffy-yellow. Beneath, forewing proximal area buffy brown-orange, distally buffy-yellow; costal area uniformly striped.

Forewing 28.5 mm., expanse 54.0 mm.

Holotype male and *allotype* female from RIO JONDACHI, near ARCHIDONA, 800 M., ECUADOR, collected by F. Martin and Hazel Brown in November, 1939. In the author's collection.

This is the most extremely marked of all the *stratonice* subspecies known to me.

PACIFIC COAST ENTOMOLOGICAL SOCIETY

M. A. STEWART
Vice-President

H. H. KEIFER
President

E. G. LINSLEY
Secretary

PROCEEDINGS

One Hundred and Seventh-seventh Meeting

The one hundredth and seventy-seventh meeting of the Pacific Coast Entomological Society was held at 2:30 p.m. on February 27, 1943, in the entomological laboratories of the California Academy of Sciences, San Francisco. President Keifer in the chair. The following members were present: H. H. Keifer, E. G. Linsley, R. C. Miller, A. E. Michelbacher, C. D. Duncan, M. A. Stewart, E. O. Essig, T. F. Kelley, R. W. L. Potts, R. F. Smith, and W. Y. Chong. Visitors were present as follows: F. M. Prince, G. L. Smith, O. G. Bacon, L. L. McRae, S. Vrana, F. M. Frost, R. King, T. Algard, J. Guttseburg, C. Madsen, H. Madsen, P. H. Arnand, W. K. Brainerd, M. Gutterman, B. Prendergast.

The minutes of the previous meeting were read and approved.

The secretary reported recent action of the Executive Board in amending Article VI, Sec. 4, of the By-laws to permit the sale of 20 life memberships in 1943 on a budget payment plan extending over not more than five years and including payments of not less than $10.00 per annum.

Professor Essig reported that the Publication Committee had appointed Dr. Linsley as editor of the Pan-Pacific Entomologist to fill the vacancy left by Dr. Usinger, now in the armed forces.

The membership committee proposed the following names: Carl J. Drake, F. M. Prince, and Harold Madsen. They were duly elected to membership.

Dr. Duncan exhibited photographs of the larviform females of a phengodid beetle, as well as a slant-faced locust and lined June beetle (*Polyphylla*). He also announced the completion of a key to the butterflies and skippers of Santa Cruz County.

Dr. Linsley discussed retarded development and delayed emergence of *Buprestis aurulenta* Linn. in structural timbers. He summarized 12 cases ranging from 9 to 26 years, observed in California over a five-year period. He pointed out that the location of the infestations in the buildings, geographical areas involved, and general habits of the species all argued that the infestations originated in the lumber yard (or possibly the forest) and existed prior to construction.

The president then presented Dr. Linsley, who read a paper entitled "Natural habitats, sources, and reservoirs of insects associated with stored food products." Dr. Linsley stated that these

insects shared a number of characteristics which combined to make them pests. (1) They have a wide and more or less cosmopolitan distribution. (2) Most of the species reproduce more or less continuously when conditions are favorable, a fact which renders them independent of seasonal and daily cycles. (3) Their small size makes them easy to overlook, making it possible to transport them unnoticed from place to place and to fail to discover their presence until a population reaches injurious numbers. (4) Some species are able to survive relatively long periods without food enabling them to endure unfavorable food conditions as well as increasing their ability to survive transportation. (5) Most stored food products insects have a wide range of food habits and many include the majority of dry food and drug products of plant and animal origin in their diet. This food range is greater than that generally attributed to most other insects. (6) Many of the species appear to have a wide range of tolerance for physical factors in the environment, especially humidity. Because in any given environment the extremes may be more significant than the means, it is likely that these insects can tolerate more extreme conditions of temperature and humidity than many less widely distributed forms. This is particularly evident with regard to the moisture content of food materials and most of the important species can survive in foodstuffs with a moisture content far below the optimum. (7) Finally, although these insects have a broad tolerance for extremes of humidity (and frequently temperature), man maintains suitable (probably optimum) conditions for most of the species in many buildings, warehouses, and food storage units.

Dr. Linsley then discussed the original habitats and natural reservoirs of several hundred species associated with stored food products, from which the following conclusions were drawn:

(1) Stored food products insects are widely distributed in nature as well as in the warehouses, granaries, and households of mankind. (2) Several of the species involved (bruchids, *Sitophilus*, *Sitotroga*, etc.) are seed infesting species which infest these same materials in nature. These insects have become pests without having to undergo further evolution of food habits. (3) A large number of insects (cryptophagids, mycetophagids, lathridiids, acarids, etc.) associated with stored food products are actually fungus feeders and their presence is due to molds and fungi existing in the foodstuffs. In nature these species are found under bark, in nests of birds, mammals and insects, in decomposing plant materials, any place where molds and fungi are present. (4) Many food products pests are general scavengers on dead plant materials. The majority of these are moths (phycitids, pyralids, etc.) but a few other groups (Anobiids, nitidulids, etc.) are involved. (5) A similar source is found in the scavengers on dead animal materials. Included are *Dermestes*, *Piophila*, *Tineola*, etc. (6) A very important natural source of stored products pests is among the scavengers or semi-predators living under bark. To this source

we must credit almost all of the tenebrionids (flour beetles, mealworms, etc.), cucujids, ostomatids, etc., and to a wood boring origin, the ptinids, anobiids, bostrichids, and scolytids. (7) Insect nests have also offered a number of pests. Several of the galleriids, phycitids, ptinids, and dermestids, in particular, may have come from this source. The pollen stored by bees may have had an important role in the evolution of the food habits of some of the species by serving as a bridge between zoophagy and phytophagy. (8) Many of the insects in stored food products are predators and parasites of other insects present. A few of these, especially histerids, clerids, anthocorids, etc., are probably attracted to the products and habitat directly rather than by any specific insects present. (9) Primary natural reservoirs are to be found in the following habitats: (*a*) bark and decomposing wood, (*b*) nests and food caches of other insects, especially bees, wasps, and ants, and (*c*) nests of birds and mammals.

After a discussion of this paper, the meeting adjourned.—E. G. LINSLEY, Secretary.

One Hundred and Seventy-eighth Meeting.

The one hundred and seventy-eighth meeting of the Pacific Coast Entomological Society was held at 2:30 p.m. on May 27, 1943, in the entomological laboratories of the California Academy of Sciences, San Francisco. President Keifer in the chair. The following members were present: H. H. Keifer, E. G. Linsley, E. C. Van Dyke, E. O. Essig, M. A. Stewart, A. E. Michelbacher, R. W. L. Potts, G. L. Smith, R. F. Smith, F. M. Prince, R. C. Miller, P. Moorhead, and P. A. Harvey.

The minutes of the previous meeting were read and accepted.

President Keifer announced the appointment of Dr. M. A. Stewart to the publication committee and Dr. A. E. Michelbacher to the program committee.

Mr. R. F. Smith reported that the alfalfa butterfly, *Colias eurytheme* Bvd., and lygus bugs, *Lygus* spp., were abundant on alfalfa in the San Joaquin Valley, indicating the possibility of damaging populations in that area later in the season.

President Keifer then presented Dr. Van Dyke, who addressed the Society upon "Entomological Type Localities on the Pacific Coast." Dr. Van Dyke confined his discussion largely to those localities which have had their names changed or which have been obliterated from various causes. He suggested that a list of such places should be compiled and published in order that future workers might know where they were. Hetch Hetchy Valley was destroyed as a collecting grounds when it was turned into a reservoir; so also was Crystal Springs in San Mateo County, a type locality for many of G. R. Crotch's species. Other places, like some of the old frontier forts vanished when the government abandoned them. Many of those near the larger communities like Los Angeles and San Francisco were destroyed by advancing cities.

The localities listed by the early Russians in Alaska and California are mainly easily placed since they are either existing communities like Unalaska, Sitka, and San Francisco, places like Fort Ross (Colony Ross) and Sutter's Fort (New Helvetia) which have been preserved as historical monuments, or stable landmarks like Point Reyes and Mt. St. Helena. Many of the J. L. LeConte localities of the eighteen fifties are cities like San Diego or San Jose, others like Isabella are small places which, however, still retain their names. The famous G. H. Horn localities of Civil War days are Fort Independence in Owens Valley, with the fort destroyed but the site preserved by the town of Independence which has grown up around it, and Fort Tejon, now an historical monument.

A few of the other noted localities mentioned by Dr. Van Dyke were Clarks' Corners, now the famous resort Wawona; Tallac, at the lower end of Lake Tahoe, now no longer a resort; Havilah, long past its zenith but still maintaining a post office; Sissons, now called Shasta City, and Soda Springs, now called Upper Soda Springs, in the upper Sacramento Valley. Smaller suburban collecting sites have suffered greatly. Redwood Canyon in Marin County has become Muir Woods, Laguinitas Canyon is a water district and closed to the public. The main San Francisco collecting ground of Henry Edwards and Behr is now the heart of Chinatown; Lone Mountain is occupied by the Catholic Women's College; Mountain Lake is in the Presidio and closed to the public, and Lake Merced scarcely remains as a collecting ground. The famous Sylvania was Ricksecker's ranch, near what is now Camp Meeker, and Camp Taylor on Paper Mill Creek in Marin County, is preserved as a picnic ground.

Following a discussion of Dr. Van Dyke's paper, the meeting adjourned.—E. G. LINSLEY, Secretary.

One Hundred and Seventy-ninth Meeting.

The one hundred and seventy-ninth meeting of the Pacific Coast Entomological Society was held at 2:15 p.m. on September 25, 1943, in the entomological laboratories of the California Academy of Sciences, San Francisco. President Keifer in the chair. The following members were present: H. H. Keifer, E. G. Linsley, C. D. Duncan, E. C. Van Dyke, M. A. Stewart, F. M. Prince, F. J. Driver, R. W. L. Potts, and R. C. Miller. Visitors were present as follows: Oscar G. Bacon, A. M. Adamson, Barbara Prendergast, and Joseph E. Ryus.

The minutes of the previous meeting were read and approved.

President Keifer announced the appointment of a nominating committee consisting of Mr. Potts, Dr. Van Dyke, and Prof. Essig (chairman), and asked that they report at the next meeting.

Dr. Van Dyke and Dr. Miller reported recent visits from entomologists in the service who were on their way overseas. Their remarks were supplemented by various others who had had recent

visits or communications from members in the service. The secretary requested that he be kept informed of the most recent addresses, ranks and branches of the service of Society members.

Mr. Prince reported the results of recent plague surveys by the U. S. Public Health Service in western United States. He reported the collection of infected fleas from *Neotoma* and *Citellus* in New Mexico, prairie dogs in eastern Colorado and parts of Montana. His remarks were followed by considerable discussion of the geography of plague.

Dr. Duncan called attention to the interesting paper on *Rosalia funebris* Mots. by Prof. Essig in the last number of the Pan-Pacific Entomologist. In view of the apparent rarity of this species, he suggested that it might be of interest to know that Rex and Norma Bartges had collected 20 or 30 specimens on California laurel (*Umbellularia californica*). Dr. Van Dyke commented that Mr. Ricksecker had collected several hundred from a skid row made of laurel, but that he, in 50 years of collecting, had taken only three live specimens.

Mrs. Prendergast spoke of her studies on the life history and habits of an as yet unidentified species of *Megachile* in San Francisco. The bees line their cells with petals from the California poppy (*Eschscholtzia californica*) and appear to be rather commonly parasitized by a species of *Coelioxys*.

The president then presented Dr. A. M. Adamson, Professor of Entomology, Imperial College of Agriculture, Trinidad, who addressed the Society on "The Biology of Trinidad Termites." Dr. Adamson briefly discussed the geographical features of the island Trinidad, situated off the coast of Venezuela near the mouth of the Orinoco River. He also remarked on the richness of its fauna and flora, pointing out that biologists wishing to spend a short visit in the tropics will find Trinidad an exceedingly favorable location, with tropical rain-forests, large swamps of fresh and brackish water, savannas and other varied types of collecting grounds within easy reach of the capital, Port-of-Spain. In the neighboring island of Tobago are superb barrier reefs of coral. There is probably no region as near to the United States where so great a variety of animals and plants can readily be seen within a small area.

The termites of Trinidad number over 70 species in some 20 genera. Two features of their biology were selected by Dr. Adamson for special consideration, their systems of defense and their feeding habits.

The most remarkable and highly developed defense practiced by termites is probably that of the genus *Nasutitermes*, in which the head of the soldiers is drawn out like a spray nozzle for the ejection of poisonous liquids. These "mobile units of chemical warfare" are very numerous, swift, and aggressive. In action they appear to be very effective against ants, the principle natural enemies of termites.

Large amounts of soil were found by Dr. Adamson in the alimentary canal of a large number of trinidad termites, especially in numerous species of *Anoplotermes* which live almost exclusively in the ground. However, other genera were also involved. It appears that these termites swallow soil after the manner of earthworms, in order to digest organic matter which it contains. This habit is probably common among tropical termites, although the literature contains few references to it. It is conceivable that termites may profoundly affect the soil in areas where abundant.

In at least some of the genera studied, Dr. Adamson found soil in the alimentary tract of soldiers, as well as workers, but not in nymphs or members of the reproductive caste. Further observations along this line should shed some light on the diet of the various castes, a subject difficult to investigate by other methods and about which almost nothing is known.

After a general discussion of Dr. Adamson's paper, the meeting was adjourned.—E. G. LINSLEY, Secretary.

One Hundred and Eightieth Meeting.

The one hundred and eightieth meeting of the Pacific Coast Entomological Society was held at 2:30 p.m. on December 18, 1943, in the entomological laboratories of the California Academy of Sciences, San Francisco. President Keifer in the chair. The following members were present: H. H. Keifer, E. G. Linsley, E. O. Essig, A. E. Michelbacher, R. F. Smith, R. C. Miller, W. H. Lange, E. C. Van Dyke, M. A. Stewart, F. M. Prince, W. M. Pearce, P. Moorehead. One visitor was present, Mr. Joseph Ryus.

The minutes of the previous meeting were read and approved.

Prof. Essig reported for the nominating committee the following nominations for officers for 1944: president, M. A. Stewart; vice-president, F. P. Keen; secretary, E. G. Linsley, and treasurer, R. C. Miller. It was moved, seconded, and passed that the secretary cast a unanimous ballot for the candidates.

Mr. Keifer then turned the gavel over to the new president, Dr. M. A. Stewart. Dr. Stewart paid tribute to the services of the retiring president and called attention to the increasing obligation of the Society to help maintain scientific values, support fundamental work, and maintain continuity of effort during the present world crisis. He urged that all members make a special effort in attendance at meetings and in helping to make the meetings interesting and worthwhile.

President Stewart then presented the retiring president, Mr. Keifer, who addressed the Society upon "Applied Entomological Taxonomy" (see p. 1). Following a general discussion of the subject, Mr. Keifer reported upon his investigations of eriophyid mites, as an example of applied taxonomy. Considerable discussion followed Mr. Keifer's paper, after which the meeting adjourned.—E. G. LINSLEY, Secretary.